Canada Lynx
Species Account

Prepared for

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Montana DNRC Forested Trust Land HCP Species Account

The enclosed "species account" was prepared to provide background information used for the development of the Montana DNRC Forested Trust Lands HCP. Species accounts identify the best available science for each species. Species accounts were reviewed by DNRC and USFWS when negotiating the HCP conservation strategies to ensure that these strategies would be biologically and technically sound and that the strategies would be advantageous to species conservation. The species accounts will also used to prepare chapter sections of the HCP and EIS. Use of species account information for the HCP was particularly important when (1) selecting where the HCP conservation strategies would be of maximum benefit for the HCP species on DNRC lands [i.e, project area], (2) selecting computer models in predicting how the existing DNRC management actions and the proposed alternatives affect each HCP species, (3) determining how existing DNRC monitoring and adaptive manage programs can be used to support the HCP, and (4) developing rationale for species conservation strategies. Species account information will be used in the EIS for preparing the affected environment section for each HCP species and for describing how existing DNRC harvest practices and associated road construction affect HCP species.

Species account information was acquired by reviewing recent relevant publications and contacting key experts in Montana and the intermountain states that were knowledgeable about recent unpublished research for each species. Species agency listing status and species distribution in Montana were also reviewed. Maps are included that provide approximate known distribution for each species.

The species account descriptions also provide information about the existing protective measures that are required by federal and state laws and regulations or were agreed to by DNRC through conservation or related agreements. Other information contained in the species accounts includes additional conservation measures developed by other agencies or HCP applicants and existing DNRC monitoring and research programs. Finally, references are provided for the background information acquired for each species.

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ACRONYMS

ARM	Administrative Rules of Montana
BLM	Bureau of Land Management
BO	biological opinion
CWD	coarse woody debris
dbh	diameter-at-breast-height
DEIS	draft environmental impact statement
DEM	digital elevation model
ESA	Endangered Species Act
DNRC	Department of Natural Resources and Conservation
FEIS	final environmental impact statement
GIS	geographic information system
HCP	habitat conservation plan
LCAS	Lynx Conservation Assessment and Strategy
MFWP	Montana Fish, Wildlife, and Parks
MNHP	Montana Natural Heritage Program
MRIT	Multi-Scale Resource Integration Tool
TSMRS	Timber Stand Management Record System
U.S.	United States
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service

1. CURRENT LEGAL AND AGENCY STATUS

Information on the legal and agency status of the Canada lynx (*Lynx canadensis*) was obtained from *Montana Animal Species of Concern* (Carlson 2003) published jointly by Montana Fish, Wildlife and Parks (MFWP) and Montana Natural Heritage Program (MNHP). This document includes information from the federal and state agencies listed below, except for the Montana Department of Natural Resources and Conservation (DNRC), and except where a reference indicates otherwise. The DNRC agency status for species was provided in an unpublished DNRC internal document (DNRC 2003a).

- U.S. Fish and Wildlife Service (USFWS)—Threatened (Lynx population in the contiguous United States [U.S.] was listed as threatened in March 2000 [Federal Register, Vol. 65, No. 58: 16051-16086]; following litigation by the Defenders of Wildlife et al., the USFWS reassessed the assigned status and determined, in July 2003, that the contiguous lynx population in the U.S. does not require listing as endangered and is appropriately listed as threatened [Federal Register, Vol. 68, No. 128: 40076-40101]).
- MFWP—S3 (rare, restricted range). Managed as a furbearer, with a closed season (MFWP 2002).
- MNHP—S3 (rare, restricted range).
- DNRC Forest Management Bureau—Follows USFWS listing.
- U.S. Forest Service (USFS)—Follows USFWS listing.
- U.S. Bureau of Land Management (BLM)—Follows USFWS listing.

2. DISTRIBUTION, SEASONAL PRESENCE, AND POPULATION STATUS

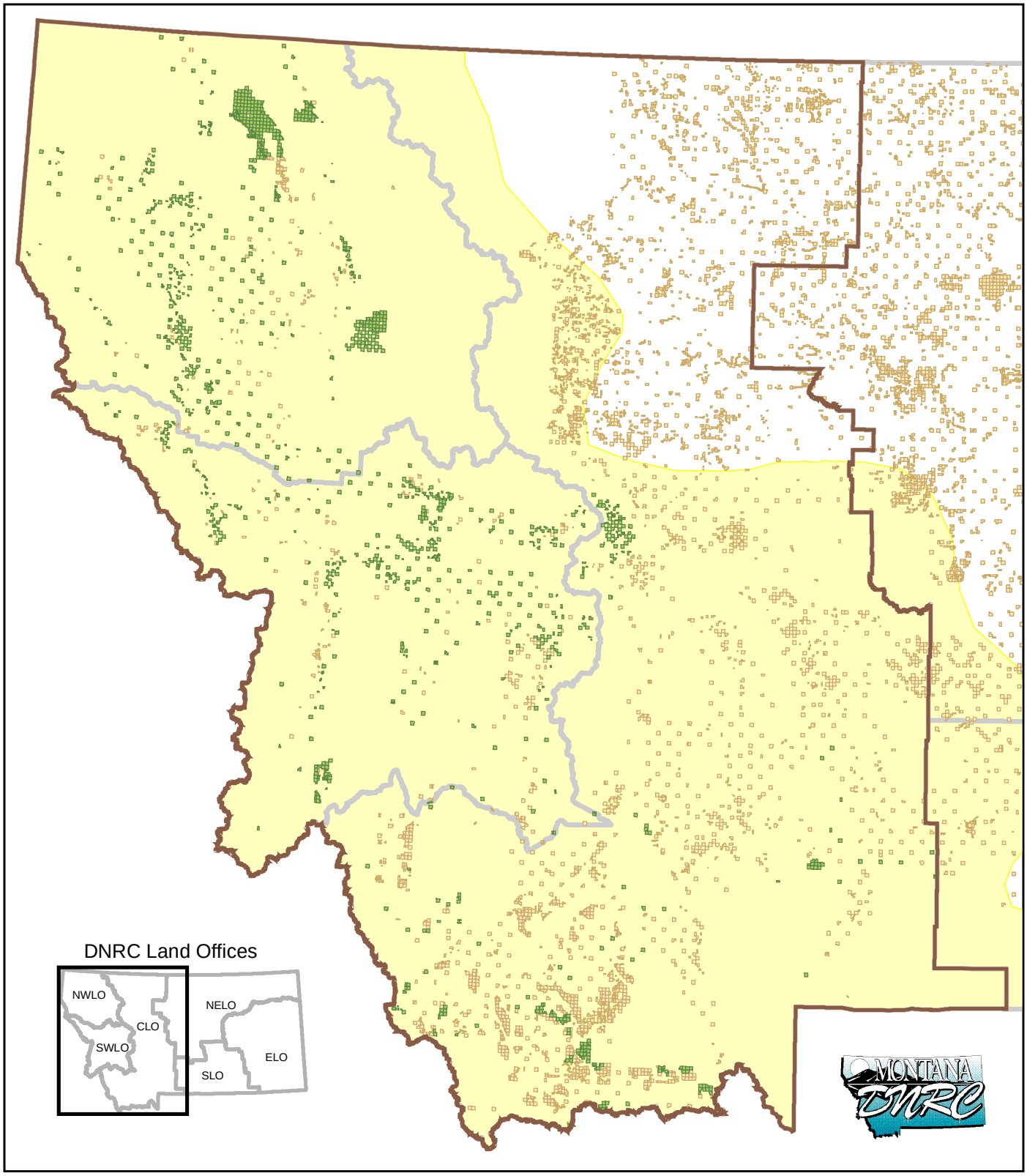
In North America, Canada lynx (hereafter lynx) occupy forested regions of Alaska and Canada, and northern portions of the Continental U.S., where they are strongly associated with boreal forests or similar types of ecosystems (Banfield 1974). The species range extends from the east to west coasts, up to the most northerly tip of Alaska, and south to Maine, Minnesota, Colorado, and Washington (Koehler and Aubry 1994; Ruediger et al. 2000). Lynx are currently widespread throughout the northern portion of their range, but are patchily distributed in the southern periphery, including the northern Rocky Mountains of the U.S. (Quinn and Parker 1987).

In Montana, the current distribution of lynx extends along the Rocky Mountains from the Canadian border to the Yellowstone area (Butts 1992; McKelvey et al. 1999a; Ruediger et al. 2000). Lynx presence has also been verified in the Big Belt, Little Belt and Crazy Mountains (Butts 1992; Ruediger et al. 2000). Trapping records indicate past lynx occupancy in the Big Snowy and Little Snowy Mountains and the Highwood Mountains of north-central Montana, but the current status of these populations is uncertain (Ruediger et al. 2000).

This distribution data closely reflects that provided by the USFWS in the July, 2003 lynx status review (Federal Register, Vol. 68, No. 128: 40076-40101). Foresman (2001) also mapped lynx distribution in Montana, and included records of dispersing and transient individuals in areas where suitable habitat was limited. Figure 1 depicts the distribution of lynx in Montana based on Foresman (2001). Lynx have been documented within the administrative boundaries of the DNRC Central Land Office, Northwestern Land Office, Northeastern Land Office, Southwestern Land Office, and Southern Land Office (DNRC 2003a). Throughout much of their Montana distribution, lynx are year-round residents, although individuals may wander extensively and temporarily occupy areas (Butts 1992; McKelvey 2003 personal communication; Ruediger et al. 2000).

Population levels of lynx typically fluctuate. These fluctuations tend to be cyclic in nature and are dependent upon several factors, such as the density of prey, locality, and movement of lynx into or out of an area. Therefore, estimates of lynx populations may vary from year to year (Breitenmoser et al. 1993). At low population levels, lynx occur at densities of approximately two to four animals per 39 square miles (Aubry et al. 1999). At high population levels, these densities may increase three or four fold, reflecting the ability of lynx populations to rebound quickly. Apps et al. (1999) postulated that southern lynx populations in British Columbia do not fluctuate as dramatically as northern populations. Koehler (1990) also reported that in the southern end of their range, where snowshoe hare (*Lepus americanus*) populations were likely noncyclic and relatively stable at low densities, the population density of lynx was approximately 2.6 individuals per 39 square miles. Restricted trapping seasons for lynx previously occurred in Montana from 1991 through 1999 with an annual quota of one lynx each for both the east and west sides of the Continental Divide. Except for the live capture of up to five animals for translocation purposes, lynx trapping has been prohibited in Montana since the 1999-2000 trapping season (Ruediger et al. 2000; MFWP 2002).

Based on an in-depth review of available data sources and interviews with trappers, fur buyers, and wildlife professionals familiar with lynx, Hash (1990) concluded that the lynx population in Montana in 1990 was lower than it had been for a number of decades. It was hoped that the population would rebound after substantially reducing the legal harvest during the 1980s. This increase did not occur and it appeared that as of 1990, the lynx population in Montana continued to decline. Hash (1990) also found that the lynx populations in Idaho and Washington also appeared to be small, with a stable or declining population trend.



N

0 15 30 45 60 Miles

Canada Lynx Distribution
Project Area
Other Trust Land
Planning Area Boundary
Land Office Boundary

Figure 1
Canada Lynx Distribution in Western Montana

Data Source: Montana Natural Heritage Program (provided by USFWS 2004).

Parametrix

Map prepared by Parametrix, Inc., September 29, 2005.
canada_lynx_sa-20050929.mxd

3. KEY LIFE REQUISITES

The lynx is a wide-ranging carnivore that makes use of relatively diverse landscapes and microhabitats. For lynx to adequately meet all life requisites, available resources (i.e., food and cover) must be distributed in a pattern that facilitates reasonable access to them.

In the western U.S., McKelvey et al. (1999a) reported that most lynx (83 percent) occurred within the Rocky Mountain Conifer Forest cover type (Kuchler 1964 as referenced in McKelvey et al. 1999a), and most (70 percent) were within the 4,900 to 6,500 ft. elevation zone. Aubry et al. (1999) cited lodgepole pine (*Pinus contorta*), subalpine fir (*Abies lasiocarpa*), and Engelmann spruce (*Picea engelmannii*) as the primary cover types providing lynx habitat in the western U.S. In extreme northwestern Montana, cedar-hemlock cover types may provide prime lynx habitat. Secondary vegetation, including cool, moist Douglas-fir (*Pseudotsuga menziesii*), grand fir (*Abies grandis*), western larch (*Larix occidentalis*), and aspen (*Populus tremuloides*) cover types may also contribute to lynx habitat when interspersed within subalpine forests (Ruediger et al. 2000). Koehler (1990) found that, in the Okanogan valley of Washington, lynx habitat use was consistent with habitat use described in other studies. In Koehler's study, lynx use of lodgepole pine habitats was four to five times greater in 20-year-old stands than in older (43- to 82-year-old) stands of lodgepole pine, and nine times greater than in Engelmann spruce and subalpine fir stands. Koehler et al. (1979) monitored a radio-collared male lynx in Montana, calculating a home range of 13.9 square miles (n = 21, minimum convex polygon home range estimator).

In the western mountains of Montana, where environmental conditions support forest habitat types similar to those of boreal forests found in northern regions, lynx utilize a variety of forest structural stages. Koehler and Aubry (1994) noted that lynx appear to use early structural stages of forest for foraging, while older structural stages are used as reproductive and denning habitats (Koehler et al. 1979). Intermediate structural stages may function as movement corridors and provide connectivity between foraging and denning habitats within a landscape mosaic of forest structural stages (Koehler et al. 1979). Landscape or topographic features identified by Apps et al. (1999) that can enhance lynx habitat and connectivity include valley bottoms, and broad, forested mountain passes. These types of features have high potential to support resident lynx and may facilitate dispersal.

In many portions of the species' North American range, lynx occupy habitats overlapping, or in association, with abundant populations of snowshoe hares (Brand et al. 1976; Butts 1992; Koehler and Aubry 1994; McKelvey et al.1999a; Mowat et al. 1999; Ruediger et al. 2000). Snowshoe hares are the primary prey of lynx and their most important food source (Koehler and Aubry 1994; Murray and Boutin 1994; Apps et al. 1999). Hares not only influence where lynx may occur, but also influence relative densities of lynx (Stenseth et al. 1997; Gamara and Sole 2000). Throughout their range, lynx rely on hares for anywhere from 35 to 97 percent of their diet; therefore, it is generally accepted that lynx select habitats with abundant snowshoe hare populations (Brand and Keith 1979; Koehler and Aubry 1994; Murray and Boutin 1994). The synchronicity of lynx and snowshoe hare populations was first described by Elton and Nicholson (1942) and has since attracted much attention from ecologists and wildlife biologists. The basic cause of the ten-year population cycle in snowshoe hares and lynx is, first, an interaction between the snowshoe hare and its food supply and, second, an interaction between snowshoe hares and its primary predator, the lynx (Keith 1974; Krebs et al. 2001).

Most lynx prey species, other than snowshoe hares, are either consumed as carrion or taken as alternate prey during periods when hare population densities are low (Ruediger et al. 2000). Despite increased use of alternate prey sources, as reported by Brand et al. (1976), hares remain the principal prey species (greatest biomass) consumed by lynx. Quinn and Parker (1987) contend that lynx select habitats frequented by hares, and described these types of foraging habitats as "…diverse forests with alternate

stands of swamp conifer for cover and shrubby openings for feeding." Specifically, structural characteristics (e.g., stand age, tree species composition, stem density, and stem height) influence the density of snowshoe hare populations and, therefore, the density of lynx populations as well (Keith 1990; Koehler and Aubry 1994). Understory stem densities and structure meeting the forage and cover requirements of snowshoe hares have been described by Hodges (1999) for the southern boreal and montane forest types. Density estimates show that hares use some seral stages more than others, preferring horizontal understory cover approximately 3 to 10 ft in height (Hodges 1999). Therefore, densely stocked stands, as well as stands with shrubs and at seral stages where branches provide more low canopy, lateral cover, are most heavily used by hares (Hodges 1999). Ruediger et al. (2000) described snowshoe hare cover and forage habitats as vegetation growing to a height of 6 ft above maximum snow depths. In a study of snowshoe hares in Montana, Griffin (2004) found that hare density decreased in forest stands that had been pre-commercially thinned, including stands that retained 0.6-acre patches that were not thinned.

There is some evidence that snow density and crust characteristics may affect lynx access to food items (Buskirk et al. 1999). Generally, snow depth and the frequency of crust formation increase from the northern to southern extent of the lynx's distribution within the Rocky Mountains (Buskirk et al. 1999). In deep snow (greater than 39 inches depth), the lynx's large feet and long legs provide a competitive advantage over other predators such as the coyote (*Canis latrans*) and cougar (*Felis concolor*). This competitive advantage may be lost in areas where moderately deep snow has been compacted by vehicles or snowmobiles, or where the snow is crusted (Buskirk et al. 1999; Ruediger et al. 2000). Hunting success may also be affected by the degree to which hare activity is confined to well-defined trails in the snow. Thus, where broad patterns of snow deposition in relation to forest cover are known, these patterns may be a useful, broad-scale indicator of prime lynx habitat.

Lynx generally select den sites in dense, mature forests that contain coarse woody debris (CWD), such as blowdown, upturned stumps, and windthrown trees. Poole (2003 personal communication) cautioned, however, that stand age is not a limiting requirement. Younger, regenerating forests can provide suitable denning habitat if adequate deadfall is present. Squires (2003 personal communication) has observed that lynx will den in small-diameter woody debris (of approximately 7-inch diameter at breast height [dbh]) when found in blowdown or "jackstraw" piles. Other important features of den sites are minimal human disturbance, proximity to foraging habitat (early seral stands), and mature stands that are between one and five acres in size (Koehler and Brittell 1990). Stand structure appears to be more important than forest cover type (Mowat et al. 1999). For denning habitat to be functional, it must be in or adjacent to foraging habitat (Ruediger et al. 2000). Slough (1999) documented the importance of burns 15 to 30 years old for lynx denning in the Yukon Territory of northern Canada, but also referred to lynx use of 5 to 50-year-old burns. Koehler (1990), Slough (1999), Mowat et al. (1999), and Squires and Laurion (1999) also cited the availability of woody debris or root wads, which are important structural components of den sites, whether in burns or in mature forest stands.

Because of the diverse habitat requirements for lynx, natural disturbances (e.g., wildland fire, insect infestation) have historically played a dominant role in maintaining the mosaic of forest successional stages necessary to support lynx populations (Ruediger et al. 2000). Thus, management of these disturbance processes is a crucial consideration in the development of a lynx management strategy. Determining the scale at which these disturbance mechanisms should operate to provide optimal conditions for lynx is currently unknown (McKelvey et al. 1999b).

Critical lynx life requisites to be included in a geographic information system (GIS) habitat model (Table 1) are listed by habitat attribute.

Table 1. Quantifiable Ecosystem Attributes for the Lynx

Attribute	Need	Model GIS Data Layers
Vegetation type	*Feeding:* Mesic to cold conifer forests from 4,500 to 6,500 ft elevation.[a,b]	*Feeding/Breeding:* Forest Vegetation Type, digital elevation model (DEM).
	Breeding: Coniferous forest stands with adequate CWD, especially mature and older stage stands.[a,b,c]	
	Cover Overhead cover, forest or shrub.[a]	
Stand/patch size	*Feeding:* No explicit patch size reported in the literature.	Patch sizes to be calculated from data layers.
	Breeding: Den sites at least 3 acres in size.[d]	*Feeding/Breeding:* Forest Vegetation Type.
	Cover: Prefers overhead cover connecting *Feeding* and *Breeding* habitat.[a]	
Stand structure	*Feeding:* Moderate to well stocked seedling to sapling initiation stage or pole to mature stage with moderate to well stocked seedling to sapling reinitiation stage present in understory.[e]	*Feeding/Breeding:* Forest Vegetation Type, Forest Vegetation Size Class.
	Breeding: Den sites within or adjacent to foraging habitat. Abundance of CWD at >75 tons per acre.[a]	
	Cover: Prefers overhead cover connecting *Feeding* and *Breeding* habitat.[a]	
Structural complexity (snags, CWD, talus, rock outcrop)	*Feeding:* Structural complexity is not required for *Feeding* habitat.	*Breeding:* Downed Woody Debris.
	Breeding: Prefers greater than 75 tons/acre CWD (equivalent to 40 9-inch-dbh soft logs/150 ft).[f]	
	Cover: Structural complexity is not required for *Cover* habitat.	

Sources:

[a] Ruediger et al. (2000)
[b] McKelvey et al. (1999a)
[c] Koehler (1990)
[d] Wolff (1980)
[e] Hillis et al. (2003)
[f] Koehler and Brittell (1990)

Notes: ft = foot.

Attribute:

Vegetation type = predominant vegetation type (i.e., conifer forest, shrub-steppe) used by a species. For some species, may include unvegetated cover types such as alpine habitat.

Stand/patch size = patch size reported in literature, typically reported as minimum, for suitable habitat.

Stand structure = predominant features of suitable habitat including stand developmental stage, stocking, size class, and canopy closure.

Structural complexity = structural habitat elements that may be required by a species. The use of these elements is species specific and this attribute may not be applicable to a given species.

Need:

Breeding = habitat necessary for courtship, breeding, birthing, and rearing of young.

Feeding = principal habitat necessary for foraging and feeding.

Cover = habitat features necessary for security while resting, foraging, and/or traveling.

3.1 CORRIDOR NEEDS

Corridors linking lynx habitats are required at two scales: (1) the population scale, which connects landscapes supporting lynx habitat, and (2) the home range scale, whereby lynx using a landscape are able to move about and meet their life requisites within their home range. Maintaining connectivity with lynx populations in Canada and between mountain ranges is an important consideration for lynx in western Montana and for populations further south in the Rocky Mountains (Ruediger et al. 2000). Lynx ranges in the northern Rocky Mountains of Montana, Idaho, and Wyoming are probably poorly connected to lynx ranges in the southern Rocky Mountains (McKelvey et al. 1999b). Barriers to lynx dispersal include highways and areas of human settlement (Apps et al. 1999: Ruediger et al. 2000). Many mountain ranges within the northern and southern Rockies are isolated by expanses of shrub-steppe and agricultural lands. While shrub-steppe and agricultural lands may afford lynx sufficient prey and cover for dispersal, the relatively high incidence of human habitation and highways within these habitat types limit their value as lynx dispersal habitat (Lewis and Wenger 1998; Ruediger et al. 2000).

While overhead cover appears to be important for lynx in meeting various life requisites, the extent to which cover influences broad-scale movements of lynx is uncertain. Schwartz et al. (2002) found high gene flow among distant populations of lynx separated by distances greater than 1,900 miles, including those in Montana's Seeley Lake, Banff National Park in Alberta, Watson Lake in the Yukon Territory, and Alaska's Kenai Peninsula. On this basis, Schwartz et al. (2002) suggested that management actions in the contiguous U.S. should focus on maintaining connectivity with the core of the lynx's geographic range, thought to be in northern Canada (McKelvey et al.1999a). At the federal level, the USFS is proposing to amend land management plans for nine national forests in Montana, and one of the key goals of these amendments will be to provide connectivity within and between lynx habitat areas (USFWS 2000). Servheen et al. (2001) identified linkage zones for grizzly bears between the large blocks of public land in the northern Rocky Mountains of Idaho and Montana. This effort has recently expanded to include linkage considerations for a variety of other species likely to be influenced by "habitat fracture zones" associated with human development. "Habitat fracture zones" are identified through evaluation of road densities, developed sites, visual cover and riparian zones.

Daily movements of lynx vary, but they do have a need to move both within and outside their home range to hunt, move kittens between alternate dens, defend their home range, and disperse to new habitats. From telemetry data in Montana, Squires and Laurion (1999) reported average lynx annual home range sizes of 85 square miles for four males and 35 square miles for one female (90 percent convex polygon estimator). Ongoing studies in Montana, Wyoming, and British Columbia have also documented exploratory movements by resident lynx during the summer months (Apps 1999; Squires and Laurion 1999). Aubry et al. (1999) described this movement as long-distance movements beyond identified home range boundaries, with individuals returning to the original home range. Exploratory movements in Montana ranged from 9 to 25 miles and for periods of one week up to several months outside of the home range (Squires and Laurion 1999).

The forests that comprise lynx habitat are subject to a number of disturbances that may effect the age, density, and species composition of the forest. Fire is the most dramatic of these disturbance events, both in the geographic extent and degree of change (Agee 1999). Stand replacing fires may render habitat unsuitable for both hares and lynx for a number of years due to the loss of forage and cover. If CWD remains after a fire, these features may be potential den sites for lynx.

3.2 KEY BIOLOGICAL RELATIONSHIPS

The ranges of snowshoe hares and lynx are nearly coincident across North America. Snowshoe hares are the primary prey of lynx, comprising anywhere from 35 to 97 percent of lynx diet throughout the lynx's

range (Koehler and Aubry 1994). Thus, to a large extent, good habitat for snowshoe hares equates to good habitat for lynx.

Subalpine fir forest associations in northwestern Montana provide optimal lynx habitat. Cover types may be mixed species composition (Subalpine fir, lodgepole pine, Douglas-fir, grand fir, western larch, and hardwoods) as well as pure lodgepole pine stands. Snowshoe hares and lynx appear to be abundant in mature forests as well young stands within this region (McKelvey 2003 personal communication).

Mowat et al. (1999) reported that red squirrels (*Tamiasciurus hudsonicus*) were the main alternate prey of lynx during periods of low hare abundance throughout much of northern Canada and Alaska. Although a diet of red squirrels alone may not be adequate to ensure lynx reproduction and survival of kittens, the species appears to be the most important alternate prey throughout the range of the lynx (Apps 1999).

For denning, lynx require structural complexity such as piles of small-diameter woody debris (Squires 2003 personal communication) and CWD (root wads, logs) (Koehler and Brittell 1990; Mowat et al. 1999; Squires and Laurion 1999). Koehler and Brittell (1990) found that den sites were typically in stands larger than 3 acres in size and with greater than 75 tons of CWD per acre. Most denning habitat is in or adjacent to foraging habitat (Ruediger et al. 2000).

4. SENSITIVITY TO COVERED ACTIVITIES

The following DNRC forest management activities are proposed for coverage under the HCP. The sensitivity of a fish or wildlife species to these activities may depend on the time of year, duration and areal extent of the activity, distance of the activity from the subject species, screening vegetation or terrain, and in some cases, the previous exposure (habituation) of the individual to the activity.

4.1 TIMBER HARVEST

Timber harvest may affect the amount, distribution, and/or quality of foraging and denning habitat available to an individual lynx and may also create conditions favoring other predators that potentially compete with or prey on lynx (Ruediger et al. 2000). Timber management can affect the spatial arrangement of lynx foraging and denning habitat. Timber harvest may influence kitten survival by temporarily reducing prey abundance within a timber harvest unit and serve as a possible source of disturbance, which may lead to den abandonment (Ruediger et al. 2000). However, timber management can also be used in conjunction with, or in place of, fire as a disturbance process to create and maintain optimal snowshoe hare habitat (densely stocked, early seral coniferous stands, greater than 40 acres in size [Hodges 1999]).

4.2 SALVAGE HARVEST

Salvage harvest following wildfires and other disturbances may negatively affect lynx habitat if most large-diameter trees are removed (Ruediger et al. 2000). Once they have fallen to the ground, large dead trees may provide an important source of cover for foraging lynx in the short-term and potential den sites in the long-term. The debris left following windstorms, in particular, can create the low, horizontal structure that lynx prefer for denning habitat.

4.3 THINNING

For application toward DNRC HCP activities, the use of the term "thinning" will generally refer to pre-commercial thinning. Since thinning prescriptions that produce commercial forest products are included as timber harvest. Pre-commercial thinning is defined under the Forest Management Rules as "the removal of trees not for immediate financial return but to reduce stocking to concentrate growth on the more desirable trees" (DNRC 2003b).

Reducing stem density in early seral stands may lower potential snowshoe hare carrying capacity (Koehler and Brittell 1990; Hodges 1999; Mowat et al. 1999). Snowshoe hares are positively associated with stem density, selecting stands with greater than 40,000 stems per acre in a Washington state study (Hodges 1999). Pre-commercial thinning reduces the density of early seral and pioneering species, including sapling-sized conifer trees and understory shrubs and is, therefore, likely to be detrimental to snowshoe hare habitat (Ruediger et al. 2000; Griffin 2004). Decreasing habitat suitability for snowshoe hares decreases the value of the habitat for foraging lynx.

4.4 CONTROL AND DISPOSAL OF SLASH

Burning or disposing of slash and CWD destroys the potential cover value they may provide to lynx and lynx prey (Ruediger et al. 2000). Particularly during the summer when snow cover is absent, post-harvest CWD remaining on the ground may provide cover for snowshoe hares and other small mammals

(Ruediger et al. 2000). Piled slash and CWD may provide lynx den sites and large logs in open areas potentially provide lynx cover for crossing forest openings (Ruediger et al. 2000).

4.5 PRESCRIBED BURNING

By returning a stand to an early seral stage, prescribed burning may maintain habitat conditions favorable to snowshoe hares. Immediately following large, stand-replacing fires, snowshoe hare and lynx population densities are low and gradually increase as the vegetation grows back and provides dense horizontal cover (Fox 1978). Conversely, low to moderate intensity fires (typical of most prescribed burns) may stimulate understory development in older stands, while maintaining the mature forest structure (Lyon et al. 2000; Ruediger et al. 2000).

Where burning prescriptions are designed to maintain CWD, snowshoe hare and lynx cover will likely not be affected. Lynx denning habitat may be reduced, however, if pockets of CWD are burned entirely (Ruediger et al. 2000). Broadcast burns often stimulate increased growth of herbaceous plants beneficial to snowshoe hares in the summer, and provide heat to release seeds of conifers with serotinous cones. Burning may promote the establishment of tree seedlings, especially lodgepole pine and aspen.

4.6 SITE PREPARATION

See Sections 4.3 and 4.4 above (Thinning and Control and Disposal of Slash, respectively).

4.7 REFORESTATION

No sensitivity to reforestation was found in the literature reviewed for the lynx. Reforestation may benefit lynx by accelerating the establishment of forest stands, potentially reducing the period after timber harvest when a site is too open to be suitable lynx habitat.

4.8 WEED CONTROL

No sensitivity to weed control was found in the literature reviewed for the lynx.

4.9 ROAD CONSTRUCTION

Little information is available on the effects of roads and trails on lynx or their prey (Apps 1999; Ruggiero et al. 1999). Construction of roads may reduce lynx habitat by removing forest cover. In areas with deep snow pack, snow compaction on roads from vehicles, snowmobiles, and skiers may enable potential lynx competitors or predators to enter areas that would otherwise be inaccessible (Buskirk et al. 1999; Ruediger et al. 2000). Conversely, in some instances, along less-traveled roads where vegetation provides good snowshoe hare habitat, lynx may use the roadbed for travel and foraging (Koehler and Brittell 1990; USFWS 2000).

4.10 ROAD MAINTENANCE

No sensitivity to road maintenance was found in the literature reviewed for the lynx.

4.11 FOREST INVENTORY

No sensitivity to forest inventory activities was found in the literature reviewed for the lynx.

4.12 MONITORING

No sensitivity to monitoring activities was found in the literature reviewed for the lynx. In general, monitoring may benefit lynx by providing more accurate and current accounts of occupied stands, thereby facilitating efforts to improve, as well as to mitigate potential impacts on, lynx populations and habitat.

4.13 GRAZING OF CLASSIFIED FOREST LANDS

By consuming several of the forbs and woody plants that are a food source for snowshoe hares, grazing livestock may compete with hares for forage resources. Grazing may reduce the distribution or abundance of native plant species, such as aspen, thereby reducing the available forage and cover for snowshoe hares (Ruediger et al. 2000). Domestic livestock grazing is common in lynx habitats in many areas of western Montana, particularly east of the Continental Divide (Ruediger et al. 2000).

4.14 GRAVEL QUARRYING FOR THE PURPOSES OF LOGGING AND ROAD CONSTRUCTION

Other than potential loss of habitat from timber and/or salvage harvest for quarry construction, no sensitivity to gravel quarrying was found in the literature reviewed for the lynx.

4.15 FERTILIZATION

No sensitivity to fertilization was found in the literature reviewed for the lynx.

4.16 ELECTRONIC FACILITY SITES

Other than potential loss of habitat from timber and/or salvage harvest due to electronic facility construction, no sensitivity to electronic facilities was found in the literature reviewed for the lynx.

4.17 OTHER ACTIVITIES COMMON TO COMMERCIAL FOREST MANAGEMENT

Generally, it is not anticipated that other activities common to commercial forest management will adversely impact lynx.

5. MANAGEMENT NEEDS AND RECOMMENDATIONS

In formulating management recommendations and conservation measures for lynx, areas currently known to support populations of lynx should be emphasized (McKelvey 2003 personal communication; Nordstrom 2003 personal communication). Forest conditions in northwestern Montana, and specifically the Seeley Lake–Swan Valley area, offer prime lynx habitat and these areas should be a management priority (McKelvey 2003 personal communication; Nordstrom 2003 personal communication).

The purpose of *Lynx Conservation Assessment and Strategy* (LCAS) is to provide guidance to federal land managers in conserving Canada lynx and lynx habitat. The LCAS was developed after the USFWS concluded in the final listing rule for lynx (March 24, 2000) that a lack of coordination and consistent land management on federal lands was one of the principal factors negatively impacting the lynx population within the continental U.S. In writing the LCAS, Ruediger et al. (2000) were guided by the following principals: best available science for lynx should be the basis of for the LCAS; future options for lynx conservation should be retained; a variety of spatial scales and ecological processes should be included; the habitat needs of other wildlife species should be integrated; and conservation measures for lynx on federal lands should be proactive and germane to land managers. The LCAS includes discussions of lynx ecology, risk factors impacting lynx and lynx habitat, and proposed conservation measures to ameliorate impacts. A number of the conservation measures are applicable at both the programmatic and project levels (Ruediger et al. 2000).

LCAS conservation measures potentially relevant to the DNRC HCP include the following:

- Maintain suitable acres and juxtaposition of lynx habitat through time.
- If the landscape has been fragmented by past management activities that reduced the quality of lynx habitat, adjust management practices to produce forest composition, structure, and patterns more similar to those that would have occurred under historical disturbance regimes.
- Evaluate whether fire suppression, forest type conversions, and other forest management practices have altered fire regimes and ecosystem functions. Mature forest stands (resulting from fire exclusion) provide lynx denning habitat, but do not provide hare, and thus lynx, forage habitat.
- Plan and manage recreational activities in ways that protect the integrity of lynx habitat, considering, at minimum, the following:
  - minimize snow compaction in lynx habitat (restrict recreational access to designated lynx habitat areas),
  - concentrate recreational activities within existing developed areas, rather than developing new recreational areas in lynx habitat (to minimize habitat fragmentation), and
  - ensure that development or expansion of developed recreation sites or ski areas that result in removal of mature forest and adjacent lands addresses landscape connectivity and lynx habitat needs.
- In lynx habitat and adjacent shrub-steppe habitats, manage grazing to maintain the composition and structure of native plant communities.
- Identify key linkage areas that may be important to landscape connectivity within and between geographic areas, across all ownerships, particularly in proximity to federal lands.
- Develop and implement a plan to protect key linkage areas from activities that would create barriers to movement. In addition to the possibility of a single project producing barriers, an incremental accumulation of multiple projects could also produce barriers.

- Evaluate the potential importance of shrub-steppe habitats in providing landscape connectivity between blocks of lynx habitat. Livestock grazing within shrub-steppe habitats in such areas should be managed to maintain or achieve mid-seral, or a more advanced condition, to maximize cover and prey availability. Such areas that are currently in late seral condition should not be degraded.

6. CURRENT DNRC PROTECTIVE MEASURES

The *Administrative Rules of Montana* (ARM), under Sub-Chapter 4 for State Forest Land Management, give the most directly applicable regulations governing management of lynx habitat on DNRC State forest trust lands. These rules were implemented to generally support populations of sensitive and listed species on State trust lands in conjunction with a mandate to generate revenue for state trust beneficiaries. DNRC accomplishes this by managing for site characteristics generally recognized as important for ensuring their long-term persistence. DNRC may accept localized adverse impacts, but only within the context of an overall strategy that supports habitat capability for these species. DNRC recognizes that its contribution toward conservation of wide-ranging animal species that occur in low densities and require large areas to support self-sustaining populations would be supportive of, albeit subsidiary to, the principal role played by federal agencies with larger land holdings. These rules restrict the scope and range of activities that may pose a threat to listed and sensitive species, including lynx. ARM specific to lynx are intended to manage forest stands in order to provide habitat connectivity and potential denning and foraging habitat for lynx.

Federal wildlife statutes, such as the *Endangered Species Act* (ESA) also apply to forest management activities on state trust lands. A brief summary of the ESA is provided in Section 6.2.

6.1 ADMINISTRATIVE RULES OF MONTANA

As a federally listed species, classified as threatened, under the Endangered Species Act (1973) as amended (ESA), the lynx is a management and conservation priority for all federal and state resource managers in Montana. Consequently, lynx are afforded protective measures by DNRC at the state level under ARM. The following excerpt(s) concerning the DNRC commitment to conserving lynx and lynx habitat is taken directly from the ARM (DNRC 2003b):

36.11.403 DEFINITIONS

(20) "Connectivity" means:

(a) the extent to which conditions exist or should be provided between separate forest areas to ensure habitat for breeding, feeding, or movement of wildlife and fish within their home range or migration areas; or

(b) regarding management of lynx and fisher habitat, stand conditions where sapling, pole, mature, or old stands possess greater than 39% crown canopy closure, in a patch greater than 300 feet wide.

(39) "Lynx denning habitat" means mature forest within lynx habitat with numerous downed logs occurring in at least five-acre patches. Younger successional stages offer denning habitat where CWD amounts are high, such as areas with extensive timber blow down.

(40) "Lynx habitat" means forest lands comprised of subalpine fir or hemlock habitat types, and moist Douglas-fir, grand fir, western red cedar, and Engelmann spruce habitat types where they are intermixed with appreciable amounts of subalpine fir habitat types. Cover types may be mixed species composition (subalpine fir, hemlock, Engelmann spruce, Douglas-fir, grand fir, western larch, lodgepole pine and hardwoods), and stands dominated by lodgepole pine.

(41) "Lynx non-habitat" means:

(a) definable winter ranges normally used by high concentrations of big game animals and associated predators regardless of habitat type; or

(b) the following habitat types:

(i) ponderosa pine and dry Douglas-fir;

(ii) limber pine;

(iii whitebark pine;

(iv) water;

(v) rock; and

(vi) permanent non-forest areas.

(42) "Mature foraging habitat (lynx)" means sawtimber stands within lynx habitat that possess moderate or well-stocked coniferous understory vegetation.

(56) "Other habitat (lynx)" means forest lands in lynx habitat that do not meet the habitat definitions for denning, mature foraging, young foraging, or temporary non-lynx habitat, but serve to provide cover to facilitate movement and acquisition of alternative prey species, such as red squirrels.

(86) "Temporary non-lynx habitat" means:

(a) seedling stands;

(b) sapling to old age class stands with less than 40% canopy closure;

(c) non-stocked clearcuts; and

(d) stand-replacement burns which are likely to develop future habitat characteristics through forest succession that are important to lynx.

(96) "Young foraging habitat" (lynx) means conifer seedling and sapling stands within lynx habitat with average height greater than or equal to six feet and density greater than or equal to 4,000 stems per acre.

36.11.428 THREATENED AND ENDANGERED SPECIES

(1) The department shall participate in recovery efforts of threatened and endangered plant and animal species. The department shall confer in its sole discretion with the United States Fish and Wildlife service (USFWS) to develop habitat mitigation measures.

(a) Measures may differ from federal management guidelines because the department plays a subsidiary role to federal agencies in species recovery. In all cases, measures to support recovery must be consistent with department responsibilities under the Endangered Species Act and Trust Law. The department shall work with the USFWS to amend such measures when, in the judgment of the forest management bureau chief, they are inconsistent with trust management obligations.

(b) Measures to support species recovery shall be periodically updated to implement new biological information and legal interpretations as warranted.

(2) The department shall, in its sole discretion, participate on interagency working groups established to develop guidelines and implement recovery plans for threatened and endangered species.

(a) If additional plant or animal species with habitat on state trust lands are federally listed as threatened or endangered, the department shall, in its sole discretion, participate in working groups for those species.

(b) The department shall, in its sole discretion, also participate in interagency groups formed to oversee management of recently de-listed species.

(3) The department staff shall report sightings of threatened and endangered species, except bald eagles, to respective working groups or an appropriate data repository.

(a) Ssubsection (a) refers only to reporting bald eagle nest sites and was omitted here.

36.11.436 THREATENED AND ENDANGERED SPECIES – CANADA LYNX

(1) The department administrative area offices where lynx rules apply to management activities include the department's northwest land office, southwest land office, central land office and northeast land office.

(2) Specific habitat elements recognized as important for lynx that occur within preferred lynx habitat types include:

(a) denning;

(b) mature foraging;

(c) young foraging;

(d) temporary non-lynx habitat; and

(e) "other" lynx habitat which does not meet structural conditions pertaining to the above habitats.

(3) The department shall generally manage for lynx habitat through the coarse filter approach, consistent with the emulation of natural processes, as described in ARM 36.11.404.

(a) When specifically assessing lynx habitat for stand identification, management, and retention the department may consider:

(i) CWD abundance;

(ii) proximity to foraging habitat;

(iii proximity to denning habitat;

(iv) proximity to class 1 streams;

(v) habitat connectivity; and

(vi) firewood cutting risk.

(4) The department shall not salvage within stands identified as necessary to meet denning habitat requirements.

(5) In areas considered for pre-commercial thinning in lynx habitat, the department shall delay thinning in young foraging habitat stands with stem density greater than or equal to 4,000 per acre until the average crop tree height is greater than or equal to 15 feet or until lower limbs have evanesced up to approximately six feet high. Post-thinning, the department shall consider these stands other habitat for a minimum of 10 years post-treatment.

(6) The department shall:

(a) minimize construction of new roads;

(b) incorporate use of temporary roads; and

(c) obstruct or obliterate unnecessary existing roads in lynx habitat.

(7) When conducting forest management activities on blocked portions of the Stillwater, Swan River or Coal Creek state forests the department shall adhere to the following:

(a) The department shall identify and retain denning habitat on approximately 5% of the total lynx habitat acreage (sum of denning, mature foraging, young foraging, and temporary

non-lynx habitat) within each applicable grizzly bear BMU sub-unit in patches greater than or equal to five acres (larger preferable).

(b) The department shall, on a BMU sub-unit basis, manage for 10% of the total lynx habitat acreage to be in a mixture of mature foraging and young foraging habitat.

(i) The department may salvage in mature foraging stands, provided that understory sapling densities are not reduced below the moderately-stocked condition, and CWD abundance is enhanced or not appreciably altered.

(8) When conducting forest management activities on all other department lands administered by the department's northwest land office, southwest land office, central land office and northeast land office, the department shall adhere to the following:

(a) The department shall maintain a minimum of five acres of denning habitat, where present, on parcels containing appreciable amounts of lynx habitat as determined at the project level.

(b) The department shall evaluate habitat suitability and retention of mature foraging habitat on parcels containing lynx habitat at the project level.

(i) On parcels containing appreciable amounts of lynx habitat in areas where broader landscape habitat conditions allow, the department shall retain approximately 10% of the lynx habitat acreage in mature or young foraging habitat. (History: 77-1-202, 77-1-209, 77-5-201, 77-5-204, MCA; IMP, 77-5-116, 77-5-204, 77-5-206, 77-5-207, MCA; NEW, 2003 MAR p. 397, Eff. 3/14/03.).

6.2 ENDANGERED SPECIES ACT

The ESA prohibits the unauthorized taking (harming, harassing, pursuing, capturing, shooting, trapping, killing) or possessing a listed (legally classified as endangered or threatened) species. Taking also applies to affecting the habitat of a listed species. Section 10(a) of the ESA allows for the issuance of a take permit for listed species following approval of an HCP that specifies: (1) the taking will be incidental; (2) the applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking; (3) the applicant will ensure that adequate funding for the plan will be provided; (4) the taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild; and (5) the measures, if any, required under (4) will be met (USFWS Undated).

7. ADDITIONAL PROTECTIVE MEASURES DEVELOPED BY OTHER AGENCIES/HCPS

In addition to the protective measures applied by DNRC (including those measures regulatory in nature or those developed by or for DNRC), other agencies or entities may have developed protective measures for lynx and their habitat.

7.1 CONSERVATION AGREEMENTS

In 1999, the USFS and the BLM prepared a biological assessment reviewing a number of USFS Land and Resource Management Plans and BLM Land Use Plans for the 16 states where the lynx had been proposed for listing under the ESA (Hickenbottom et al. 1999). The purpose of the biological assessment was to examine federal land management policy that may impact the conservation of lynx. In the final listing rule for the lynx, the USFWS concluded that the chief threat to the lynx in the contiguous U.S. was the lack of guidance in federal land management planning (Hickenbottom et al. 1999; Ruediger et al. 2000). In the biological assessment, the authors recommend amending federal land use plans. These amendments were to follow the LCAS in developing programmatic conservation measures for lynx (Hickenbottom et al. 1999).

After the listing of the lynx in 2000, the USFS and BLM each signed a separate lynx conservation agreement with the USFWS (USFWS 2000). The conservation agreements specify that federal land management agencies in Montana will implement and lead a number of population, ecology, and habitat-based research and monitoring efforts for lynx following research recommendations contained in the LCAS.

In Montana, the Beaverhead-Deerlodge, Bitterroot, Custer, Flathead, Gallatin, Helena, Kootenai, Lewis and Clark, and Lolo National Forests will amend their forest plans to include lynx conservation strategies. On USFS lands, with a few exceptions for projects involving third parties, activities that may affect lynx on development allocations are addressed by adherence to the LCAS and its conservation measures for lynx. For example, the USFS has curtailed its pre-commercial thinning on USFS lands since signing the conservation agreement (USFWS 2000).

The conservation agreements are programmatic in nature and direct fundamental changes in USFS and BLM land management plans within the range of the lynx (USFWS 2000). Conditions of the conservation agreements relevant to land management within lynx habitat include (USFWS 2000):

- Plans should incorporate conservation measures from *Ecology and conservation of lynx in the United States* (Science Report) (Ruggiero et al. 1999), the LCAS, and the USFWS's final listing rule (published in the Federal Register, Vol. 65, No. 58: 16051-16086).
- Lynx habitat, lynx analysis units, and key linkage areas will be identified and mapped on all BLM and USFS lands following guidelines in the LCAS.
- The USFS agrees during project planning to use the LCAS for guidance in lynx effects determinations.
- The BLM will consider whether a proposed activity will impact lynx prior to making a determination on the activity. In considering impact(s) to lynx, the BLM will use recent lynx research, the Science Report, and the LCAS.
- Ongoing actions will be reviewed for compliance with the ESA and other federal statutes as new information on the lynx becomes available.

7.2 BIOLOGICAL OPINION

In October, 2000, the USFWS issued the biological opinion on the biological assessments prepared by the BLM and USFS. The USFWS determined that management under the current BLM and USFS land management plans in conjunction with the terms of the conservation agreements should not jeopardize the continued existence of the lynx (USFWS 2000). The biological opinion included a number of conservation recommendations including (USFWS 2000):

- Continue lynx monitoring and survey efforts on USFS and BLM lands.
- Initiate research on lynx ecology as outlined in the Science Report (Ruggiero et al. 1999).
- Initiate research on the impacts of human activities on lynx as outlined in the LCAS, specifically including the following: pre-commercial thinning; snow compaction; highways and key linkage areas; forest road density; human disturbance; aspen and snowshoe hare; shrub-steppe habitat; grazing; and refugia.

7.3 NORTHERN ROCKY MOUNTAINS LYNX AMENDMENT DRAFT ENVIRONMENTAL IMPACT STATEMENT

In January 2004 the USFS and BLM published the *Northern Rocky Mountains Lynx Amendment draft environmental impact statement* (DEIS), which proposes to amend land management plans on 18 national forests and 4 BLM administrative units in the western U.S. (USFS and BLM 2004). The purpose of the programmatic DEIS is to modify management plans for USFS and BLM lands in the Northern Rocky region in a manner that contributes to recovery of the lynx and at the same time maintains the multiple-use mandate of these agencies (USFS and BLM 2004). The DEIS is not intended to analyze impacts to lynx from site-specific actions. Potential impacts of site-specific actions would need to be evaluated separately for each proposed action.

The 5 alternatives discussed in the DEIS, including a no action alternative (Alternative A) incorporate issues identified by agency staff and the public during scoping. Management issues addressed in the DEIS include recreation, roads, mineral resources, grazing, fire, and vegetation. All of these issues are discussed in each of the alternatives and the relative importance of an issue is the principal difference between the alternatives. The proposed action (Alternative B) presents clear management guidance (goals, objectives, standards, and guidelines) for reducing or eliminating threats to the survival of lynx on USFS and BLM lands based on recommendations in the LCAS (USFS and BLM 2004). Two of the alternatives focus on the management of winter recreation and foraging habitat, while the fifth alternative emphasizes the potential affects of fire management on lynx and lynx habitat (USFS and BLM 2004).

Public comment on the DEIS was accepted until April 15, 2004. These comments will be considered in the selection of an alternative and preparation of the final environmental impact statement (FEIS). Once the FEIS is published, the respective USFS regional foresters and BLM state directors will decide how and where (National Forest, BLM administrative unit) to amend the management plans (USFS and BLM 2004).

8. EXISTING DNRC MONITORING AND RESEARCH PROGRAMS

The ARM require monitoring of threatened, endangered, and sensitive species on State trust lands. An implementation monitoring report that includes threatened, endangered, and sensitive species monitoring and timber sale wildlife mitigation compliance, is prepared every 5 years. The most recent report was prepared for fiscal year 2000. In this report, incidental sightings by DNRC staff of listed and sensitive species, including lynx, are recorded and reported to the MNHP. Three lynx sightings were documented by the Northwestern Land Office in the fiscal year 2000 report (DNRC 2000).

DNRC recently funded a snowshoe hare study conducted on the Stillwater State Forest to gather information on snowshoe hare habitat use, particularly as related to pre-commercial thinning treatment intensity in mixed conifer forests (final report in preparation) (Baty and Frank 2003 personal communication).

8.1 CANADA LYNX LEVEL ONE TECHNICAL TEAM

DNRC is a Canada Lynx Level One Technical Team participant (following listing of the species). DNRC attends meetings and has been involved in discussions involving habitat management and policy formulation addressing conservation needs (Baty and Frank 2003 personal communication).

8.2 PUBLIC LANDS LINKAGE TASK FORCE

DNRC is an active cooperator on the Interagency Public Lands Linkage Task Force. This organization, comprised of state, federal and tribal entities, was formed to address wildlife linkage concerns associated with human developments and access across western Montana. DNRC has managed state trust lands that have been identified through this effort (Baty and Frank 2003 personal communication).

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